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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/724,876	12/02/2003	Haitham H. Akkary	042390.P17875	1560

8791 7590 12/11/2006

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EXAMINER

LI, AIMEE J

ART UNIT	PAPER NUMBER
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2183

DATE MAILED: 12/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/724,876

Applicant(s)

AKKARY ET AL.

Examiner

Aimee J. Li

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 January 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 December 2006 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>20 April 2004</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 1-26 have been considered.

Papers Submitted

2. It is hereby acknowledged that the following papers have been received and placed of record in the file: Specification as received on 02 December 2003; Abstract as received on 02 December 2003; Drawings as received on 02 December 2003; Claims as received on 02 December 2003; Oath or Declaration as received on 20 April 2004; IDS as received on 20 April 2004; and Change of Address as received on 20 September 2005.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on 20 April 2004 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Drawings

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: pages 16-18, paragraphs 00059-00060, reference numbers 739, 750, 778, 788, 752, and 754. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and

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informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

5. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: Figure 8, elements 774, 777, 784, 787, 737, 717, and 727. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

6. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "738" in Figure 7 and "737" in Figure 8 have both been used to designate AGP/High Performance Graphics and are referred to by the same number (738) in the specification. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New

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Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

7. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "718" in Figure 7 and "717" in Figure 8 have both been used to designate a bus bridge and referred to by the same number (718) in the specification. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

8. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "728" in Figure 7 and "727" in Figure 8 have both been used to designate a data storage and referred to by the same number (728) in the specification. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If

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the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

9. The drawings are objected to because in Figure 7, element 734 is labeled as "Memory Center" however is referred to in the specification as "Memory Controller". Please correct the drawings or the specification to maintain consistency and reduce confusion as to what element 734 is referred to as. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

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10. The abstract of the disclosure is objected to because the Abstract page contains the text "DC2/#499968" when the page should be clean of everything but the abstract and it's associated section title and invention title.. Correction is required. See MPEP § 608.01(b).
11. The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

Arrangement of the Specification

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

- (a) TITLE OF THE INVENTION.
- (b) CROSS-REFERENCE TO RELATED APPLICATIONS.
- (c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
- (d) THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT.
- (e) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC.
- (f) BACKGROUND OF THE INVENTION.
 - (1) Field of the Invention.
 - (2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
- (g) BRIEF SUMMARY OF THE INVENTION.
- (h) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
- (i) DETAILED DESCRIPTION OF THE INVENTION.
- (j) CLAIM OR CLAIMS (commencing on a separate sheet).
- (k) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
- (l) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

12. The disclosure is objected to because of the following informalities: The specification does not contain a "Brief Summary of the Invention".
13. Appropriate correction is required.

Claim Rejections - 35 USC § 112

14. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

15. Claim 9 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The claim recites the limitation “wherein an oldest checkpoint is reclaimed when a subsequent checkpoint is generated.”

However, the specification teaches, and as known in the art, that the oldest checkpoint is reclaimed when a subsequent checkpoint is generated **and no dependencies on the checkpoint instruction exists**. As claimed, the language merely states the oldest checkpoint is reclaimed whenever a new checkpoint needs to be generated with no other conditions being met, so the oldest checkpoint is replaced whenever a new checkpoint is created without determining whether the oldest checkpoint has dependencies left on it. The specification has not disclosed this and it is not known in the art how to ensure that program coherency and data consistency is maintained, which is the purpose of a checkpoint, when it is arbitrarily replaced when a new checkpoint needs to be created.

16. Claim 10 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The claim recites “wherein one or

more of said checkpoints are combined based upon the misprediction probability of said one or more instructions associated with said one or more of said checkpoints.” There is no other language within the claims or in the specification to describe this process. The specification only contains one sentence describing this as a function in an alternative embodiment about combining checkpoints. It is not well-known in the art, and other than the current language in the claim and specification, how this would be implemented. It would cause undue experimentation and place undue burden on those of ordinary skill in the art to create a device as claimed without further explanation from the specification.

17. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

18. Claim 10 recites the limitation “checkpoints are combined” and “the misprediction probability” in lines 1-2. There is insufficient antecedent basis for this limitation in the claim. First, the specification fails to describe how to combine checkpoints. Second, a misprediction probability has not been established in any of the prior claim language.

Claim Rejections - 35 USC § 102

19. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

20. Claims 1-3, 5-9, 11-13, 17-21, and 25-26 are rejected under 35 U.S.C. 102(b) as being taught by Green, U.S. Patent Number 5,946,718 (herein referred to as Green).

21. Referring to claim 1, Green has taught a method, comprising:

- a. Generating a checkpoint at one of a plurality of branches in a checkpoint buffer having at least one checkpoint buffer entry (Green column 12, lines 18-47 and Figure 2), wherein said plurality of branches include one or more instructions (Green column 11, line 31 to column 12, line 11; Figure 2; and Figure 3);
- b. Generating a counter for said at least one checkpoint buffer entry (Green column 12, lines 18-47 and Figure 2);
- c. Associating said one or more instructions with said checkpoint (Green column 12, lines 18-47 and Figure 2); and
- d. Tracking with said counter said one or more instructions associated with said checkpoint (Green column 12, lines 18-47 and Figure 2).

22. In regards to Green, the checkpoint stores the machine state and increments a counter when speculative execution occurs. When the speculated instruction is resolved, the checkpoint is either cleared or accessed to restore the machine state. The counter associated with the checkpoints is also modified when the speculated instruction is resolved.

23. Referring to claim 2, Green has taught the method of claim 1, further comprising:

- a. Accessing said checkpoint at the occurrence of a recovery event (Green column 12, lines 33-47 and Figure 2);
- b. Restoring an architectural state associated with said checkpoint (Green column 12, lines 33-47 and Figure 2); and
- c. Processing at least one instruction from said one or more instructions associated with said checkpoint (Green column 12, lines 33-47 and Figure 2). In regards to

Green, the instruction that caused the checkpoint has to be processed to determine whether the prediction was correct or incorrect.

24. Referring to claim 3, Green has taught the method of claim 1, further comprising reclaiming said checkpoint when said counter indicates that said one or more instructions associated with said checkpoint have been completed (Green column 12, lines 33-47 and Figure 2). In regards to Green, the checkpoint is cleared based upon whether the instruction was correct or not, e.g. the predicted instruction has been completed and the actual result is known and the prediction can be determined whether it was correct or not.

25. Referring to claim 5, Green has taught the method of claim 1, wherein generating said checkpoint occurs when a checkpoint buffer entry is available (Green column 12, lines 42-45). In regards to Green, the checkpoints are generated when speculative execution of floating-point instructions and conditional branches occurs, which is limited to 4 speculated instructions at a time. Consequently, there can be, at most, four checkpoints and no more checkpoints will be generated when there are no more speculative execution slots available.

26. Referring to claim 6, Green has taught the method of claim 1, further comprising processing beyond said plurality of branches without generating said checkpoint when said checkpoint buffer entry is not available (Green column 12, lines 42-45). In regards to Green, the speculative execution is for floating point instructions and conditional branches. Even when the speculative execution is full, it does not stop until another floating-point instruction or conditional branch is encountered. This means that integer and logical instructions after the last speculated floating-point instruction or conditional branch continue executing, e.g. integer and logical instructions beyond the branch are processed.

27. Referring to claim 7, Green has taught the method of claim 1, wherein said tracking step further comprises:

- a. Incrementing said counter when said one or more instructions is allocated (Green column 12, lines 18-47 and Figure 2);
- b. Decrementing said counter when said one or more instructions completes execution (Green column 12, lines 18-47 and Figure 2).

28. Referring to claim 8, Green has taught the method of claim 1, wherein checkpoints are reclaimed in a first-in-first-out order (Green column 1, line 49 to column 2, line 17; column 7, lines 14-27; and Figure 3). In regards to Green, pipelines execute instruction in-order, meaning that the first instructions put into the pipeline are the first instructions to complete the pipeline, e.g. first instructions out of the pipeline. Branch and floating-point instructions are processed by the X-pipeline, this means they are retired in-order, so the reclamation of the checkpoints happens in-order, e.g. first-in-first-out.

29. Referring to claim 9, Green has taught the method of claim 1, wherein an oldest checkpoint is reclaimed when a subsequent checkpoint is generated (Green column 1, line 49 to column 2, line 17; column 7, lines 14-27; and Figure 3). In regards to Green, pipelines execute instruction in-order, meaning that the first instructions put into the pipeline are the first instructions to complete the pipeline, e.g. the oldest instructions are first out of the pipeline. Branch and floating-point instructions are processed by the X-pipeline, this means they are processed in-order, so the reclamation of the checkpoints happens in-order, e.g. the oldest checkpoint is reclaimed first. When a subsequent checkpoint is generated, and the oldest checkpoint has been cleared, the subsequent checkpoint takes its place.

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30. Referring to claims 11 and 19, taking claim 19 as exemplary, Green has taught a system, comprising:

- a. A processor including a branch predictor to generate a checkpoint at one of a plurality of branches (Green column 12, lines 18-47 and Figure 2), and a checkpoint buffer to store one or more counters (Green column 12, lines 18-47 and Figure 2),
- b. Wherein said checkpoint buffer has at least one checkpoint buffer entry (Green column 12, lines 18-47 and Figure 2),
- c. Wherein said branch predictor generates a counter for said at least one checkpoint buffer entry to associate one or more instructions with said checkpoint (Green column 12, lines 18-47 and Figure 2), and
- d. Wherein said branch predictor tracks said one or more instructions using said counter (Green column 12, lines 18-47 and Figure 2);
- e. An interface to couple said processor to input-output devices (Green column 4, line 56 to column 5, line 61; Figure 1; and Figure 2); and
- f. A data storage coupled to said interface to receive code from said processor (Green column 4, line 56 to column 5, line 61; Figure 1; and Figure 2).

31. In regards to Green, the checkpoint stores the machine state and increments a counter when speculative execution occurs. When the speculated instruction is resolved, the checkpoint is either cleared or accessed to restore the machine state. The counter associated with the checkpoints is also modified when the speculated instruction is resolved.

32. Claim 11 is similar in limitations to claim 19. Claim 11 differs only in that it claims an apparatus, rather than the system of claim 19, and does not contain limitations (e) and (f) above.

33. Referring to claims 12 and 20, taking claim 20 as exemplary, Green has taught the system of claim 19,

- a. Wherein said branch predictor accesses said checkpoint at the occurrence of a recovery event (Green column 12, lines 33-47 and Figure 2),
- b. Restores an architectural state associated with said checkpoint (Green column 12, lines 33-47 and Figure 2), and
- c. Processes at least one instruction from said one or more instructions associated with said checkpoint (Green column 12, lines 33-47 and Figure 2). In regards to Green, the instruction that caused the checkpoint has to be processed to determine whether the prediction was correct or incorrect.

34. Claim 12 is similar in limitations to claim 20. Claim 12 differs only in that it claims an apparatus rather than the system of claim 20.

35. Referring to claims 13 and 21, Green has taught the system of claim 19, wherein said branch predictor reclaims said checkpoint when said counter indicates that said one or more instructions associated with said checkpoint have been completed (Green column 12, lines 33-47 and Figure 2). In regards to Green, the checkpoint is cleared based upon whether the instruction was correct or not, e.g. the predicted instruction has been completed and the actual result is known and the prediction can be determined whether it was correct or not.

36. Claim 13 is similar in limitations to claim 21. Claim 13 differs only in that it claims an apparatus rather than the system of claim 21.

37. Referring to claims 17 and 25, taking claim 25 as exemplary, Green has taught the system of claim 19, further comprising a recovery buffer to store previously executed instructions for use in misprediction recovery (Green column 12, lines 18-47 and Figure 2).

38. Claim 17 is similar in limitations to claim 25. Claim 17 differs only in that it claims an apparatus rather than the system of claim 25.

39. Referring to claims 18 and 26, taking claim 26 as exemplary, Green has taught the system of claim 19, wherein said branch predictor further comprises a branch target buffer to store said one or more instructions (Green column 11, lines 31-56 and Figure 2).

40. Claim 18 is similar in limitations to claim 26. Claim 18 differs only in that it claims an apparatus rather than the system of claim 26.

Claim Rejections - 35 USC § 103

41. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

42. Claims 4, 14-16, and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Green, U.S. Patent Number 5,946,718 (herein referred to as Green) as applied to claim 1 above, and further in view of Dirk Grunwald, Artur Klauser, Srilatha Manne, and Andrew Pleszkun's "Confidence Estimation of Speculation Control" IEEE ©1998 (herein referred to as Grunwald).

43. Referring to claims 4, 14, and 22, taking claim 22 as exemplary, Green has not taught the system of claim 19, further comprising a branch confidence estimator to estimate a misprediction

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probability for one or more of said plurality of branches. Grunwald has taught estimating a misprediction probability for one or more of said plurality of branches (Grunwald page 122, paragraphs 1-5 and page 125, paragraphs 1-2 and 4). Green has taught that there is speculative execution, particularly with floating-point instructions and conditional branches (Green column 12, lines 18-47). However, Green has not taught the specifics of the speculative execution, e.g. how the speculative execution specifically controlled. Grunwald has taught that confidence estimates, e.g. misprediction probabilities, are a way to control speculation (Grunwald page 122, paragraphs 1-5 and page 123, paragraph 3). A person of ordinary skill in the art at the time the invention was made, and as taught by Grunwald, would have recognized that improve prediction rates (Grunwald page 122, paragraphs 1-5). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the confidence estimates of Grunwald in the device of Green to improve prediction rates.

44. Claims 4 and 14 are similar in limitations to claim 22. Claims 4 and 14 differ only in that claim 4 claims a method and claim 14 claims an apparatus rather than the system of claim 20.

45. Referring to claim 15, Green in view of Grunwald has taught the apparatus of claim 14, wherein said branch confidence estimator accesses misprediction history information (Grunwald page 122, paragraphs 1-5 and page 125, paragraphs 1-2 and 4).

46. Referring to claims 16 and 24, taking claim 24 as exemplary, Green in view of Grunwald has taught the system of claim 23, wherein said branch confidence estimator further comprises a counter associated with said branch having a high misprediction probability and adapted to track when said branch is mispredicted (Grunwald page 122, paragraphs 1-5 and page 125, paragraphs 1-2 and 4).

47. Claim 16 is similar in limitations to claim 24. Claim 16 differs only in that it claims an apparatus rather than the system of claim 24.

Conclusion

48. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

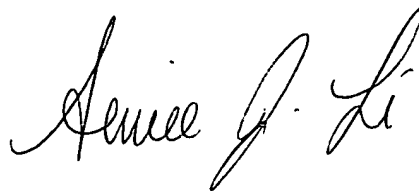
- a. Ando, U.S. Patent Application Publication 2001/0005880 has taught checkpoints storing a processor status at a branch prediction.
- b. Garg et al., U.S. Patent Numbers 5,497,499; 5,737,624; and 5,974,526 has taught tracking instruction dependencies via counters.
- c. Bluhm, U.S. Patent Number 5,784,589 has taught checkpoints to store the processor status for recovery if a branch is mispredicted.
- d. McMahon, U.S. Patent Number 5,867,724 has taught creating checkpoints when speculatively executing conditional branch instructions.
- e. Brooks et al., U.S. Patent Number 5,961,636; Green, U.S. Patent Number 6,301,647; and Beard, Sr. et al., U.S. Patent Number 6,351,797 has taught generating checkpoints for a register rename table when predicting branch instructions.
- f. Wilkerson et al., U.S. Patent Number 6,662,273 has taught counters tracking data dependency.
- g. Scott McFarling's "Combining Branch Predictors" Digital Western Research Laboratory ©1993 has taught using branch history tables and confidence estimators for branch predicting.

- h. Adrian Cristal, Matea Valero, Antonio M. Gonzalez, and Josep Llosa's "Large Virtual ROB's by Processor Checkpointing" ©September 2002 has taught checkpointing instructions.
- i. Andreas Moshovos's "Checkpointing Alternatives for High Performance, Power-Aware Processors" ACM ©August 2003 has taught checkpointing instructions.

49. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aimee J. Li whose telephone number is (571) 272-4169. The examiner can normally be reached on M-T 7:00am-4:30pm.

50. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

51. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



AJL
Aimee J. Li
16 November 2006